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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/535,605

02/02/2006

Frank Baumann

Umicore 0140-US

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EXAMINER

GREGORIO, GUINEVER S

ART UNIT

PAPER NUMBER

4162

MAIL DATE

DELIVERY MODE

08/04/2008

PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/535,605	<b>Applicant(s)</b> BAUMANN ET AL.	
	<b>Examiner</b> GUINEVER S. GREGORIO	<b>Art Unit</b> 4162	

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 07 August 2006.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-11 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-11 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)            | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | Paper No(s)/Mail Date. _____                                      |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>05/19/2005</u> .  | 6) <input type="checkbox"/> Other: _____                          |

## DETAILED ACTION

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 1-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Topsoe et al. (U.S. Pat. No. 6,059,995) in view of Wieland et al. (U.S. Pub. No. 2002/0009408 A1) and Maruko et al. (European Pub. No. EP 1 094 030 A2).

Topsoe et al. teaches the preparation of hydrogen-rich gas from a feedstock by adiabatic catalytic steam reforming in the presence of an oxygen containing atmosphere (column 1, lines 9-13). Topsoe et al. teaches heat necessary for the endothermic steam reforming reactions is supplied through oxidation of part of hydrogen in the steam reformed feedstock in heat conducting relationship with the steam reforming reactions (column 1, lines 45-48). Topsoe et al. teaches steam reforming reactions and partial oxidation of hydrogen in series and are carried out in one or more catalyst zones

Art Unit: 1791

arranged adiabatically (column 1, lines 49-51). Topsoe et al. teaches a number of fixed bed catalyst layers of a reforming catalyst and intermediate beds of oxidizing catalyst (column 2, lines 3-5). Topsoe et al. teaches a catalyst comprising noble metals such as platinum and/or palladium according to conventional catalyst manufacturing procedure (column 1, lines 60-62).

Wieland et al. teaches an adiabatic process for autothermal catalytic steam reforming of hydrocarbons (abstract, lines 1-10). Wieland et al. teaches autothermal steam reforming combines the advantages of catalytic partial oxidation with those of steam reforming. Wieland et al. teaches the required reaction temperature of between 600 and 900 °C for partial oxidation and steam reforming to merge smoothly into each other. Wieland et al. teaches catalyst material at least one platinum group metal on a finely divided oxidic support material (paragraph 16, lines 1-2). Wieland et al. further teaches suitable oxidic support materials for the platinum metals are oxides from the group comprising aluminum oxide, silicon dioxide, titanium dioxide or mixed oxides thereof and zeolites (paragraph 17, lines 1-4). Wieland et al. teaches the reaction temperature for aliphatic or aromatic hydrocarbons or mixtures of hydrocarbons such as gasoline or diesel oil is chosen so that the outlet temperature from the catalyst is between 600 and 900 °C (paragraph 21, lines 1-3).

Maruko et al. teaches the temperature required for reforming methane is 700-750 °C (paragraph 3, lines 12-15). Maruko et al. teaches the forming temperature for aliphatic alcohols can go as low as 250 to 350 °C (paragraph 14, lines 1-5). Maruko et al. teaches the reforming reaction being an endothermic reaction causes the gaseous

Art Unit: 1791

mixture to reduce in temperature, but the presence of the oxidizing catalyst in the reforming reaction catalytic bed or layer down streams permits an unreacted portion of the hydrocarbon or aliphatic alcohols still further to react with such residual oxygen (paragraph 16, lines 8-15).

The autothermal process is known in the art of hydrogen production. As stated by Wieland et al., supra, autothermal steam reforming combines the partial oxidation, an exothermic reaction, with steam reforming, and endothermic reaction. Furthermore, Wieland et al. teaches the reaction temperature for aliphatic or aromatic hydrocarbons or mixtures of hydrocarbons such as gasoline or diesel oil is chosen so that the outlet temperature from the catalyst is between 600 and 900 °C (paragraph 21, lines 1-3). Maruko teaches the reforming temperature for methane is 700-750 °C. Lastly, Maruko et al. teaches the forming temperature for aliphatic alcohols can go as low as 250 to 350 °C (paragraph 14, lines 1-5). Maruko does not teach a temperature for merging smoothly between partial oxidation and steam reforming. Wieland et al. teaches the reaction temperature of between 600 and 900 °C for partial oxidation and steam reforming to merge smoothly into each other.

It would have been obvious to one of ordinary skill in the art at the time of the invention to set up multiple catalyst zones arranged to operate adiabatically and efficiently. In other words, it would have been obvious to one of ordinary skill in the art at the time of the invention to arrange the catalyst zones so that the heat generated in one catalyst zone will be used to supply the energy for the subsequent downstream catalytic zones and do so in a manner which would be optimal for the reaction process

Art Unit: 1791

such as ensuring the temperature of the gas passing from the autothermal step to steam reforming step is between 600 and 900 °C. The series of catalyst zones correspond to multiple stages.

Regarding claim 4, Maruko et al. teaches a ratio of water vapor to hydrocarbon range between 2.5 and 3.5 (paragraph 19, lines 1-3). It would have been obvious to one of ordinary skill in the art at the time of the invention to expect a residual amount of carbon at the end of the auto thermal step because the auto thermal reaction is a chemical processes inherently possess an equilibrium wherein the reaction does not all of the starting material, hydrocarbon.

Regarding claim 8, Wieland et al. teaches using one or more water gas shift steps to remove carbon monoxide (paragraph 22, lines 5-6). It would have been obvious to one of ordinary skill in the art at the time of the invention to use multiple water gas shift steps to remove carbon monoxide because carbon monoxide because carbon monoxide is a known pollutant that adversely affects the environment.

Regarding claim 9, Topsoe et al. teaches the process may be performed in a quench type adiabatic reformer or adiabatic heat exchanger with a number of fixed bed catalyst layers (column2, lines 1-4). Also, the series of catalyst zones correspond to multiple stages.

Regarding claim 10 and 11, Wieland et al. teaches the object of the invention is to provide a process for autothermal steam reforming which is characterized by a very high hydrogen productivity and is thus particularly suitable for use in mobile systems (paragraph 11, lines 1-4). Wieland et al. does not specifically say fuel cells but it would

Art Unit: 1791

have been obvious to one of ordinary skill in the art at the time of the invention to use a high hydrogen producing systems in a fuel cell because hydrogen is the fuel source for fuel cells.

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to GUINEVER S. GREGORIO whose telephone number is (571)270-5827. The examiner can normally be reached on Monday-Thursday, 10:30-5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jennifer McNeil can be reached on 571-272-1540. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a

Application/Control Number: 10/535,605

Page 7

Art Unit: 1791

USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

GSG

July 30, 2008

/Melvin C Mayes/

Primary Examiner, Art Unit 1791